

Joint Defra/EA Flood and Coastal Erosion Risk
Management R&D Programme

Annex B.3:

Case study no.3:

Assessment of the Dymchurch sea defence scheme

R&D Project Record FD2013/PR2

Produced: November 2004

Statement of use

This report provides guidance on the use of MCA and ASTs to assist in the appraisal of flood and coastal erosion risk management projects, strategies and policies. It should be noted that it does not constitute official government policy or guidance, which is unlikely to be available until work to develop the methodology and identify appropriate sources of data has been undertaken through pilot studies.

This report may be downloaded from the Defra/EA R&D Programme website (<http://www.defra.gov.uk/environ.fcd/research>), use the search tool located on the project information and publications page. Copies are held by all EA Regional Information Centres, contact The Environment Agency's National Customer Contact Centre by emailing enquiries@environment-agency.gov.uk or by telephoning 08708506506.

Dissemination Status

Internal: Released internally

External: Released to public domain

Keywords: Multi criteria analysis, MCA, appraisal summary table, AST, decision rule

Research contractor contact details:

Lead contractor: Risk & Policy Analysts Ltd (RPA), Farthing Green House, 1 Beccles Road, Loddon, Norfolk, NR14 6LT (Tel: 01508 528465; Fax: 01508 520758; www.rpald.co.uk). The project director was Meg Postle, the project manager for RPA was John Ash with research support from Susana Dias and other members of RPA staff.

The research team also included: Colin Green (Flood Hazard Research Centre, Middlesex University); Alan Pearman (University of Leeds); Ron Janssen (The Institute of Environmental Studies, Free University, Amsterdam), Terry Oakes and Hugh Payne (Independent Consultants)

Acknowledgements

The assistance of those providing information for the case studies is gratefully acknowledged.

Defra project manager: Matt Crossman, Defra, 3D Ergon House, Horseferry Rd, London, SW1P 2AL. Email: matthew.crossman@defra.gsi.gov.uk

Publishing organisation

Defra
Flood Management Division
Ergon House
Horseferry Road
London SW1P 2AL
Tel: 020 7238 3000
Fax: 020 7238 6187

www.defra.gov.uk/environ/fcd

— Crown copyright (Defra); 2005

Copyright in the typographical arrangement and design rests with the Crown.

This publication (excluding the logo) may be reproduced free of charge in any format or medium provided that it is reproduced accurately and not used in a misleading context. The material must be acknowledged as Crown copyright with the title and source of the publication specified. The views expressed in this document are not necessarily those of Defra or the Environment Agency. Its officers, servants or agents accept no liability whatsoever for any loss or damage arising from the interpretation or use of the information, or reliance on views contained herein.

Published by the Department for Environment, Food and Rural Affairs. Printed in the UK, March 2005 on recycled material containing 80% post-consumer waste and 20% totally chlorine free virgin pulp.

PB No. 10734/PR2

ISBN 0-85521-146-6

1. Introduction

This report presents the MCA-based project appraisal process for the Dymchurch Sea Defence Scheme. This scheme appraisal follows as much as possible the original appraisal process carried out by the Environment Agency (EA).

The base information reported here is based on the following:

- visit to Dymchurch Sea Defence Scheme, followed by meeting with Steve Thompsett (EA Project Manager), Chris Powel and Ray Traynor (BBR) and Anita Ferguson (EA Kent Area Improvements Engineer);
- High Knocke to Dymchurch Sea Defence Scheme Environmental Scoping Study (BBR, 2003);
- Project Appraisal Report (PAR) for the High Knocke to Dymchurch Redoubt Sea Defences (Environment Agency, 2004);
- Folkestone to Rye Coastal Defence Strategy Main Report (HR Wallingford, 2001); and
- Folkestone to Rye Coastal Defence Strategy Executive Summary (HR Wallingford, 2001).

1.1 Summary of the project area

The stretch of coast between High Knocke and Dymchurch Redoubt lies within Shepway District in Kent, between St Mary's Bay and Hythe. The area covers management units (MU) 18/7 to 18/13 as identified in the Beachy Head to South Foreland Shoreline Management Plan (SMP) and in the Folkestone to Rye Coastal Defence Strategy.

Dymchurch town centre, with shops, businesses and housing, extending along the A259, relies on existing seawalls for protection against inundation. Land levels are generally between 2 and 3 metres above mean sea level, i.e. up to 2 metres below the high water mark of spring tides and as much as 3 metres below predicted 50-year water levels.

The housing and nature of buildings in Dymchurch and St Mary's Bay have a variety of origins. These include remains of a 12th Century Parish Church and the old village of Dymchurch dating back to the 14th Century (including an inn), through to the 20th Century bungalows that form the majority of the housing (many of which are let as holiday homes). The main shopping area is close to the sea front and includes the amusement arcade and several shops associated with the touristy character of the town. The New Beach Holiday Centre is a dominant feature on the A259 at the northern end of Dymchurch and there are a number of other caravan sites (with a combined total of 630 caravans).

In terms of landscape, the massive Dymchurch wall and the three Martello Towers dominate the coastal landscape of Dymchurch town and St Mary's Bay.

The sandy beaches between Dymchurch Redoubt and St Mary's Bay are the main reason for the development of a tourist resort along this coastline. The imposing bulk of the Dymchurch Wall separates the beach from the low-lying land on which Dymchurch and St Mary's Bay are built. The beaches have a gentle slope giving a large expanse of firm sand for the traditional seaside pursuits at low tide as well as providing safe bathing. At each high tide the beaches are completely covered.

There is an amusement arcade and fun fair close to the beach. The car parks at High Knocke and St Mary's Bay also provide a focus for holidaymakers and day-trippers using the beaches. There are also public slipways at Dymchurch and High Knocke. Access to the beach can be gained by steps over the seawall at many other points. These are used by people walking to the beach from the hotels, campsites, caravan sites and rented accommodation along the coast. Thus the whole length of the beach is used for recreation with clusters of people around the main centres and car parks.

Tourism facilities in the area include the New Beach Holiday Centre with 20 chalets at Dymchurch and 5 caravan parks in the St Mary's Bay and Dymchurch area that hold around 630 caravans.

1.2 Existing defences

The sea defences from High Knocke to Dymchurch Redoubt consist of original clay embankments which have been progressively dressed on their seaward face, protected on the crest and have had rear upstand walls added at various dates. The seawalls throughout the Dymchurch frontage have been affected by falling beach levels over many years and now, in areas, require urgent attention. Shingle occurs only sporadically as a narrow fillet at the toe of the walls, and the low sand foreshore allows larger waves to reach the seawall (BBR, 2003). The defences are generally much older than other sections of Management Unit 18 and need frequent maintenance and major upgrading, in response to wave induced damage, deterioration due to old age and the effects of long term foreshore lowering (BBR, 2003).

From High Knocke to Chapel Road the beach levels are relatively stable but the width of the foreshore between high and low water of medium tides reduces from 350m at the southern end to 250m at the northern end of the frontage. The situation is further exacerbated by the inability of the present system of long and short timber groynes along this frontage to arrest the littoral currents in this area.

Under the current maintenance policy, present standard of defence is less than 1 in 10 years and a breach (probably within 5 years) of defences could lead to flooding of the urban settlements and of Romney Marsh (BBR, 2003).

According to the Folkestone to Rye Coastal Defence Strategy (HR Wallingford, 2001) the primary agent of coastal change in this area is wave action at the

shoreline. The study area is exposed to the prevailing south-westerly winds giving rise to severe storm attack at the coast.

Severe flood damage occurs when extreme wave and water levels conditions combine. However this is rare as the correlation between extreme water level and wave height is relatively low (on average once every 200 years for a storm event) (HR Wallingford, 2001).

In what relates to beach behaviour, the Folkestone to Rye Coastal Strategy estimates that the net sand drift in from south west to north east at an average rate of 100,000 m³/a in the Dymchurch frontage, increasing from 80,000 m³/a on the west to 100,000 m³/a on the east.

1.3 Policy framework

In 1996 a Shoreline Management Plan (SMP) was produced for the stretch of coastline between Beachy Head, in East Sussex and South Foreland, in Kent. The framework developed within the SMP sets out a protocol for a sustainable approach to shoreline management on a wide area scale.

The preferred policy option identified in the SMP for the area is to hold the line, by continuing maintenance of the walls to maintain the defence to the backshore area. The SMP also noted that this area provides an opportunity for realignment, which would require secondary defence lines, remodelling of drainage outfalls and consideration of the presently important coastal road (HR Wallingford, 2001).

In 1998 the Environment Agency and the Shepway District Council jointly commissioned HR Wallingford to undertake the development of the Strategy Plan for the area extending from Folkestone to Rye, following the policy framework set out in the SMP. This strategy was agreed in 2001¹.

The Folkestone to Rye Coastal Defence Strategy identifies broad-brush opportunities and constrains for coastal management over the next fifty years as well as a more detailed Coastal Defence Implementation Plan for the next five years based on need.

The Folkestone to Rye Coastal Defence Strategy (HR Wallingford, 2001) admits that in the medium to long term (< 50 years) the Hold the Line policy identified in the SMP is appropriate. It adds, however, that future planning actions should recognise that continued protection is not sustainable in the very long term (> 50 years) and retreat may ultimately need to be considered.

¹ According to Steve Thompsett (Environment Agency Project Manager), the approval of the FRCDS is pending on approval of two or more schemes included in it, such as Dymchurch Coastal Defence Scheme.

1.4 List of stakeholders and interested parties

A communication plan was issued in 2001 for the Dymchurch Sea Defence Scheme (BBR, 2003). The plan listed the consultees and outlined the key requirements for consultation during the project development.

Consultation of stakeholders followed from the consultation undertaken during the preparation of the Coastal Defence Strategy, where a broader range of options was considered.

The consultation for the scheme was carried out internally within the Environment Agency and externally to key statutory and non-statutory consultees. The List of statutory and non-statutory consultees is presented in Table 1.1.

Table 1.1: List of stakeholders of the High Knocke to Dymchurch Redoubt sea defence scheme

Statutory	<ul style="list-style-type: none"> • Environment Agency • Countryside Agency • Crown Estate Commissioners • Defra • English Nature • English Heritage 	<ul style="list-style-type: none"> • Kent County Council • Member of Parliament • Member of European Parliament • Rother District Council • Shepway District Council • East Kent Constituency MEP
Non-Statutory	<ul style="list-style-type: none"> • CPRE • National Trust • National Farmers Union • RSPB • Friends of the Earth • Royal National Lifeboat Institution • National Grid Co Plc • Houses of Parliament • Ministry of Defence • DFT Ports Division • Sandgate Society • New Romney Town Council • Dymchurch and Burmarsh Ward (Lib Dem and Conservative) • Hythe West Ward (Labour) • Kent Tourism Sector Group • South East England Tourist Board • Ramblers Association • British Horse Society • Romney, Hythe and Dymchurch Railway • Lathe Barn Farm • Dymchurch Caravan Park • Centre for the Environment Fisheries and Aquaculture Science (CEFAS) • Kent & Essex Sea Fisheries Committee • Kent & Dungeness Fishermens Association • South Kent Angling Association • Hastings Fishermen's Protection Society 	<ul style="list-style-type: none"> • Clive Vale Angling Club • Kent Wildlife Trust • Romney Marsh Countryside Project • Romney Marsh Research Trust • South East Otters and Rivers Project • Southern Water Services Ltd • Folkestone and Dover Water Services • Parish Councils: Burmarsh, Newchurch, Postling, Saltwood, Stanford, Dymchurch, Lympe, St. Mary in The Marsh, Romney Marsh. • St Mary in the Marsh Ward • Country Landowners • Country Landowners Association • New Beach Holiday Village • E and J Piper Caravan Park • MW's Family Amusement Park • Folkestone Yacht and Motor Boat Club • Hythe and Saltwood Sailing Club • Royal Yachting Association • Kent Landsailing Club • The Sports Council • Hastings, Bexhill and District Freshwater Angling Association • Rye and District Angling Society Ltd • Cranbrook and District Angling Club • Rye Fishermen's Association • New Beach Angling Club • Dungeness Fishermen's Protection Society • Local Fishermen

Source: BBR (2003): **High Knock to Dymchurch Redoubt Sea Defence Scheme – Environmental Scoping Study**, Internal Working Paper, Revision II, October 2003.

Notes: Individual landowners in the seafront region of this study area have also been contacted separately and consultation packs will also be made available to Dymchurch shop owners through Mr Woolls at the Amusement Park (Babtie Group, 2003).

Consultation was undertaken during the following stages of the development of the project:

- screening and option identification;
- scoping exercise;
- draft environmental report or environmental statement; and
- environmental action plan.

In addition, a beach users survey and a Contingent Valuation Method (CVM) survey were also undertaken at Dymchurch to assess the value of the sandy beach to the local community and visitors.

2. Definition of objectives and management options

According to Babtie Group (2004) the works will be developed to meet the Environment Agency's operational aim of reducing *"the risk of flooding from rivers and the sea to people, property and the natural environment by providing effective defences and awareness"*.

In order to meet the broader aims of the Environment Agency, including sustainable defence, the following objectives have been developed (Environment Agency, 2004):

- to maintain protection against overtopping of defences by storms with a minimum return period of 1 in 100 years for a period of 100 years;
- to reduce the risk of breach of defences;
- to provide minimum adverse effects on the coastal zone in construction, operation and decommissioning;
- to include suitable measures to mitigate against identified environmental impacts; and
- to maintain the recreational amenity value of the frontage.

The Shoreline Management Plan and the Folkestone to Rye Coastal Defence Strategy have confirmed a long-term policy of hold the line. The Folkestone to Rye Coastal Defence Strategy (FRCDS) identified the High Knocke to Grand Redoubt frontage (Dymchurch) as Priority Action No.3. The existing standard of defence at Dymchurch was identified as 1:10 years and a standard of 1:100 years was recommended.

The options for the Dymchurch area considered during the development of the scheme are presented in Table 2.1.

The Folkestone to Rye Coastal Defence Strategy did not seem to fully resolve the preferred option for Dymchurch. The preferred options (regional and local) focussed on a major beach management solution using either a sand or shingle beach, with control structures and minor works to the seawall. Consultation on the strategy had identified that the sand option was preferable on amenity grounds as the reputation of Dymchurch, as a coastal resort, is built upon its sandy beaches.

Table 2.1: Defence options considered for the Dymchurch sea defence scheme

Options		Description
1	'Do-nothing'	Would result in progressive failure of the seawall with potential catastrophic breach and associated flooding.
2	Do Minimum (Maintain)	Involves continuing the current annual maintenance works of the sea wall. This work is reactive to damage incurred at particular locations and typically involves filling surface voids in the revetments with mass concrete. The standard of protection afforded is 1 in 10 reducing to 1 in 3 after 25 years.
3	Sustain	From High Knocke to Martello Tower 23, seal and strengthen the existing seawall aprons with new concrete stepwork extending at least two metres below existing beach with a sheet piled toe. In addition, raise the rear seawall parapet and reconstruct the promenade along the entire length. From Martello Tower 23 to Dymchurch Redoubt, the seawall aprons would be replaced by rock revetment, with access provided by concrete steps. The standard of protection afforded is 1 in 10.
4	Improve with Shingle	From High Knocke to Martello Tower 23, shingle beach recharge, structural work to upper wall and terminal rock groynes. The beach would need to be recharged to a level of +6m ODN with a crest of 10 to 15 metres wide. Terminal groynes would be placed at each end of the recharged beach to separate, perch, and retain shingle above the sand beaches. From Martello Tower 23 to Dymchurch Redoubt the seawall aprons would be replaced by rock revetment, with access provided by concrete steps. The standard of protection is 1 in 50
5	Improve with Sand	From High Knocke to Martello Tower 23, this option would be the same as sustain except that sand recharge would cover the existing toe and base of the apron removing the need to upgrade the seawall below this level. The maximum beach crest level that can be maintained is 2.5m ODN with a slope of approximately 1 in 50. The work would include timber groynes at each end of the recharge beach and at intermediate locations to maintain sand levels. Frequent recharge of areas of erosion would be required. From Martello Tower 23 to Dymchurch Redoubt the seawall aprons would be replaced by rock revetment, with access provided by concrete steps. The standard of protection afforded is 1 in 50
Notes: adapted from Environment Agency (2004). In the PAR for Dymchurch the consultants divide the study frontage in two and provide options for each section.		

3. Structuring the problem

This section aims to break down the problem into its component parts, identifying the set of impacts and associated criteria that will be used to make the decision. In other words it carries out a screening exercise for the Dymchurch coastal defence scheme.

3.1 Summary of the screening exercise

This screening exercise is used to determine (i) which categories are relevant and (ii) which categories will be appraised by assigning monetary value to impacts and which will be appraised by assigning a score to the impacts. Relevant categories are those where there is a difference in the impacts of the 4 options being appraised ('do-nothing', sustain, improve and improve plus).

The detailed high level screening for both Dymchurch is presented in Appendices A3.1 to this report - Appraisal Summary Table for Flood Management and Coastal Defence for High Level Screening (AST-FMDC-S) – Table 3.1 summarises the results of the screening exercise.

The screening exercise highlighted the fact that the majority of the more significant impacts of the Dymchurch Sea Defence Scheme (DSDS) are related to economic assets such as housing and commercial premises as well as agricultural land, and to recreation and tourism activities in the area, such as the beach and the landscape in general. There are some environmental impacts, but these are not so significant given that the area does not encompass great conservation interests.

It also becomes clear that cost benefit analysis (CBA) will be the main valuation tool, since the more significant impact categories can be valued using this technique. Multi-criteria analysis (MCA) will be particularly important when assessing the historical environment impacts category, which plays a very important role in this frontage, and some of the recreational sub-categories, also very significant. Table 3.1 indicates which categories of impacts will be valued using CBA and which categories will be assessed using MCA.

Table 3.1: Table summarising the results in the screening exercise

Project name	Dymchurch Sea defence scheme	
Category	Monetary value	Score
<i>Economic impacts</i>		
Assets	✓	
Land use	✓	
Transport	✓	
Business development		✓
<i>Environmental impacts</i>		
Physical habitats		✓
Water quality		✓
Water quantity		
Natural processes		
Historical environment	✓	
Landscape and visual amenity		✓
<i>Social impacts</i>		
Recreation	✓	✓
Health and safety		✓
Availability and accessibility of services		✓
Equity		✓
Sense of community		✓
<i>Cross-cutting impacts</i>		
Policy Integration		✓

4. Cost of options

The whole life costs considered for each of the options being assessed are detailed in Table 4.1. These costs are based on those provided by Environment Agency (2004), and adjusted to take into consideration adjustments made during the case study appraisal. In the Dymchurch Coastal Defence Scheme PAR, the coast is divided into two different assessment units. Costs of options were given for both units. In order to take into account small differences in appraisal, the costs of the most similar option for each unit was selected and then added up to give the cost of the option being implemented for the whole of the frontage.

Table 4.1: Cost of options for the Dymchurch coastal defence scheme

Options	Actual cost (£m)	Capital cost (£m)	Maintenance costs (£m)	PV (£) costs (£m)
'Do-nothing'	0.0	0.0	0.0	0.0
Maintain 1:10 to 1:3	5.8	0.0	5.8	2.1
Sustain 1:10	50.3	39.8	10.5	32.3
Improve 1:50 Shingle	75.1	60.8	14.4	38.6
Improve 1:50 Sand	125.3	108.1	17.3	56.5

5. Assessment of impacts

5.1 Qualitative and quantitative assessment

The qualitative and quantitative assessment of the different options for each of the management units was carried out using the Appraisal Summary Table for the Main Assessment (MA-AST) and it is presented in Appendix B3.2 to this Annex.

The assessment followed a stepped approach, starting with the qualitative assessment of all impact categories and moving to the quantitative assessment whenever information was available.

5.2 Monetary valuation of impacts

All of the following information was obtained from the Folkestone to Rye Coastal Defence Strategy (FRDC) Study (HR Wallingford, 2001) and High Knocke to Dymchurch Redoubt Sea Defences Project Appraisal Report (Environment Agency, 2004). The damage assessment in the PAR was developed from the damage assessment produced for the FRCDS. The appraisal period was extended to 100 years, the discount rates were changed to 3.5% and substituting the FLAIR Flood damages by the ones in the Multicoloured Manual (MCM).

Benefits accruing from provision of defences (i.e. damages avoided) can be subdivided into 4 categories:

- write-off benefits;
- intermittent flooding after breach benefits;
- overtopping benefits; and
- erosion benefits.

5.2.1 Write-off benefits

Assets

Where flood damage is suffered so frequently that the present value of the flood damage during the life of the scheme exceeds the value of the property, the property is written off and the losses are capped at the write-off value of the property.

Residential property value prices have been obtained from a combination of data including that from Office of the Deputy Prime Minister, the Halifax and HM Land Registry.

A method based on the house equivalent method was used to calculate the value of commercial properties. In addition, a category of 'Special Parks' is used to value assets such as holiday camps and amusement parks. For write-off value, 1 Special Park is equivalent to 10.1 household equivalents, i.e. £808,000.

For Caravans that would be written-off it is considered that they could be relocated. Instead a nominal sum of £2,000 has been assigned to each caravan to cover relocation expenses, as indicated as an appropriate upper limit by MAFF.

Land use

Farmland flooded by salt water once every 10 years or lost through erosion is considered to be unfit for agriculture. In this situation the value of the loss is assumed to be the risk-free market value of the land multiplied by a factor of 0.45 to reflect the inflated price of agricultural land resulting from Government subsidy.

The survey of land values for the southeast region was used to calculate the risk-market value of agricultural land.

Historical environment

For many of the Schedule Ancient Monuments (SAM) and archaeological features of the area there is a statutory duty to protect them from damage. Therefore, the assessment of their value in national economic terms would be unnecessary. A nominal value of £2,000,000 has been assigned to each.

5.2.2 Intermittent flooding after breach

Assets

The value of recurrent flood damage to properties has been calculated using standard references (FLAIR and Yellow Manual, updated to the Multicolour Manual). It was considered that all properties flooded are inundated by salt water for a period of less than 12 hours. This is a reasonable assumption since the majority of properties are at risk from salt water flooding and the multitude of drainage pathways across the Marsh act to remove the worst of any flood waters.

For caravans, a threshold level is assumed to be 500mm above the surrounding ground level.

Land use

For the occasional losses of agricultural output as a result of flooding, i.e. losses of crop or land unfit for production for one year, a distinction has been made between arable and pastureland. According to the June 1997 Agricultural and Horticultural Census, the approximate ratio between pasture and arable land use is 1 to 2.4 for the Kent Region.

For pastureland it has been assumed that livestock can be moved to a safer area, and the only cost is the loss of land use against which a rent is required. This constitutes a transfer payment and therefore cannot be considered. If, however, the land is damaged and the livestock cannot return for a long period of time, the write-off value of the land is used.

For arable land, a gross margin has been assumed to reflect the national loss. This approach was coupled with a local farmers survey regarding details of crops and produce prices.

Transport

The damages incurred by transport infrastructures under the 'do-nothing' option were calculated using the methodology recommended by the Yellow Manual, i.e. consideration of the likely diversion that would be required and any increase in cost associated with using such diversion.

For the A259, two different diversions were considered, and the cost of disruption is defined by the difference in the cost of travelling either diversion 1 or 2 compared with travelling the normal route.

5.2.3 Erosion protection benefits

Assets

In what regards outfalls and pumping stations, in the event of continued erosion they could be lost. The nominal replacement cost (£200,000) of these structures is used.

Historical environment

For many of the Schedule Ancient Monuments (SAM) and archaeological features of the area there is a statutory duty to protect from damage. Therefore it was decided that assessment of their value in national economic terms would be unnecessary. A nominal value of £2,000,000 has been assigned to each.

5.2.4 Monetary valuation of intangible benefits

Recreation

Dymchurch is known for its sandy beach, which is popular both with local residents and visitors. However, due to the age of the defences protecting Dymchurch there is a risk that the beach will be lost.

In order to identify the importance of the beach to amenity and recreation, a Contingent Valuation Assessment was commissioned (HR Wallingford, 2003).

The recreation losses will be calculated using information supplied in this study. It is known that there are approximately 160,000 visitors to the beach each year and that each of them is willing to pay £3.59 per visit.

5.3 Scoring of impacts

Scoring of impacts across the different options and their justification is presented in tabular format below. Table 5.1, overleaf, shows the scores for the Dymchurch.

Both the 'Zero to 100' and 'relative to 100' scoring systems were applied to this case study. The exercise demonstrates that the robustness of the scores is intrinsically related with the quality and quantity of information available. It also shows that when the base information for the scores is sparse, it is easier to use a '0 to 100' score system simply because in this case two of the options are fixed and the remaining options have to be assessed in relation to these two. However, this situation may not reflect accurately the reality, in particular in what concerns proportionality between the options.

Table 5.1: Table summarising scores and monetary estimates

Project name	Dymchurch (scores given here are not weighted; monetary values are in PV terms over 100 years at 3,5% (reducing)).					
Category	Option 1:	Option 2:	Option 3:	Option 4:	Option 5:	Scores justification
Economic impacts						
	0	70	70	81	100	Both the Strategy and the Scheme appraisal identify tourism as a major contributor to the local economy. It is estimated that between 7% and 14% of all employment in Shepway District, is provided by tourism (HR Wallingford, 2001). Considering that the quality status of the coast, in particular the beach, will significantly influence tourism, it is assumed that any change (positive or negative) to the coast will have a significant impact on business development. In this context, the option that will score the highest (100) is the one that will have the most positive influence (option 5). Option 4 will have a less positive effect. According to the Beach Users Survey (HR Wallingford, 2002), if the beach were to be built up with shingle instead of sand there would be a loss of 19% in visitor numbers. The same study indicates that 30% of visitors would not visit another beach in the area if the beach amenity were lost. For this reason, a score of 70 was given to option 2 and 3.
Business development	55	85	85	86	100	Both the Strategy and the Scheme appraisal identify tourism as a major contributor to the local economy. It is estimated that between 7% and 14% of all employment in Shepway District, is provided by tourism (HR Wallingford, 2001). Considering that the quality status of the coast, in particular the beach, will significantly influence tourism, it is assumed that any change (positive or negative) to the coast will have a significant impact on business development. If we assume that the situation as it is today has no impact on business development, i.e. option 2 and 3 (maintain and sustain will be assumed to have approximately the same impact) then, options 4 and 5 will have a benefit in relation to the situation today and 'do-nothing' will have an impact. According to the Beach Users Survey (HR Wallingford, 2002), if the improve with shingle and improve with sand option were to go ahead, 1% and 15% of visitors respectively will visit the beach more often, and hence create more business. In this context, option 5 would score the highest (100), options 2 and 3 would score 15 points below option 5 (i.e. 85) and option 4 would score 1 point more than existing situation (i.e. 86) As for the 'do-nothing' option, the same study indicates that 30% of visitors would not visit another beach in the area if the beach amenity was lost, hence its scores 55, or 30 points below the current situation.

Table 5.1: Table summarising scores and monetary estimates

Project name						
Dymchurch (scores given here are not weighted; monetary values are in PV terms over 100 years at 3,5% (reducing)).						
Category	Option 1:	Option 2:	Option 3:	Option 4:	Option 5:	Scores justification
Environmental Impacts						
Physical habitats	-	-	-	-	-	The environmental assets of the local area are not very many and, in the regional context, not very significant. It is believed that the differences between the impacts of the options are not big enough to warrant a scoring exercise. Although the protection of the environmental assets will prevent loss of some species and habitats of local importance, it could be argued that the return to a more natural coastline is the preferred option in an environmental perspective.
Water quality	0	20	20	100	100	There is no quantitative indication of the impact on water quality of the different options being assessed, which makes the scoring exercise difficult. It is known that if do-nothing is the preferred option the impacts will be the greatest, in particular after breaching (a score of zero). If the defences are maintained in its place then the impacts will depend on the frequency of flooding and area affected, with the options that protect to a 1 in 50 return period scoring 100 and the options protecting against 1 in 10 scoring 20. This scoring will tend to overestimate the impacts of the lower standards of defence.
	1	20	20	100	100	
Historical environment	(included in assets)	Although information is available on what types of monuments are being impacted upon by the flooding, there is no information available on which monuments were flooded by each flood event. Therefore it was decided to score the historical environment using flood frequency as a base, with the improve options scoring 100 because they protect the monuments from a flood with a return period higher than 1 in 50, 'do-nothing' scoring zero because monuments are vulnerable to all floods plus erosion, sustain will score 20 because it protects from floods that have return periods bigger than 1 in 10 and maintain scoring 12 because they protect from floods with 1 in 10 return period reducing to 1 in 3 over time (so average 1 in 6 return period).				
Landscape and visual amenity	0	86	86	66	100	The landscape and visual amenity will be impacted mostly through the change in the nature of the sandy beach in front of Dymchurch; therefore the scoring of this category should be based on this characteristic. 'Do-nothing' will have a fatal impact on the sandy beach of Dymchurch which will end up disappearing due to erosion. This option therefore scores 0/1. The option of improving the flood and coastal defences including nourishment of the beach with sand will improve the quality of the landscape beyond of what it is today. In terms of sandy beach this option will be scoring the highest score (100). It can be assumed that both maintain and sustain options will secure the beach levels as they are at present. According to the results of the Dymchurch beach users survey (HR Wallingford, 2002) if the sand levels were to be raised slightly, 14 % of visitors (local and outside visitors) would visit the beach more often, therefore maintain and sustain score 86 points. The
	1	86	86	66	100	

Table 5.1: Table summarising scores and monetary estimates

Project name						
Dymchurch (scores given here are not weighted; monetary values are in PV terms over 100 years at 3,5% (reducing)).						
Category	Option 1:	Option 2:	Option 3:	Option 4:	Option 5:	Scores justification
						survey results also tell you that if the beach were to be nourished with shingle instead of sand 33% of visitors would visit the beach less often, therefore improve with shingle as a score of 66.
Social impacts						
Health and safety	0	12	20	100	100	Health and safety impacts would be most affected by the risk of flooding to the population, stress and anxiety and the risk caused by deteriorating defences. The first issue will relate mostly with frequency of flooding whilst the second will relate to the management or abandonment of the defences. This then means that do-nothing would be the worst option (most frequent flooding and no management of defences), the maintain option would score 12, sustain 20 and both improve options would score 100.
	1	12	20	100	100	
Availability and accessibility of services	0/1	12	20	100	100	The same reasoning applied to health and safety would be applied to this category.
Equity	0	79	86	93	100	The Dymchurch area is considered to be neither a deprived nor an affluent area. In this context it could be assumed that, as long as the present situation is sustained, the level of equity is maintained. Hence, the option that scores the lowest score is 'do-nothing' with 0, since it would potentially create losses of jobs relating to tourism and recreation. Options 3, 4 and 5 will keep the level of protection to a level where no write-of of assets and infrastructure will occur, so one can assume that the deprivation standard will be at least maintained. It is also true that an improvement of the coastal strip, brought by improved defences, will potentially create more jobs which in turn may make the area more affluent, keeping in mind that the increasing beach levels with sand will potentially create more tourism related activity than with shingle. It is also known that an estimated 7% to 14% of all employment in Shepway District is provided by tourism. Using a best case and worst case scenario it could be assumed that improving with sand would create 14% more jobs, improving with shingle would create 7% more jobs and that letting the existing standard of defence be reduced (over time) would potentially mean the loss of 7% of tourism employment (maintain option with a standard of 1 in 3 would mean writing off commercial properties for example). Hence, the best-scored option would be improve with sand with 100, followed by improve with shingle with 93, followed by sustain with a score of 86 and finally maintain with a score of 79.

Table 5.1: Table summarising scores and monetary estimates

Project name		<i>Dymchurch (scores given here are not weighted; monetary values are in PV terms over 100 years at 3,5% (reducing)).</i>				
Category	Option 1:	Option 2:	Option 3:	Option 4:	Option 5:	Scores justification
	65	79	86	93	100	For this scoring the same reasoning as before would be applied. However, for 'do-nothing', we can assume that in a worst-case scenario all employment arising from tourism (14%) would be lost. Hence 'do-nothing' would score
Sense of community	0	100	100	100	100	Sense of community is mostly affected by loss of property, jobs and business development. Scoring this category on the basis of loss of jobs and business development could incur in double counting with equity. Loss of property (the physical loss rather than the monetary loss) would then be the most relevant factor in scoring this category. Since loss of property would only occur in the 'do-nothing' option, it could be said that this option would score 0 while all the other options would score 100, at least in the short and medium term.
	54	100	100	100	100	The same reasoning would be applied as above. However it is known that under do-nothing 1147 out of 2471 properties would be totally lost (46%). In this context, 'do-nothing' would score 54.
Cross-Cutting Impacts						
Policy Integration	-	-	-	-	-	

6. Weighting

6.1 Weighting methods and analysis used

It was not possible to directly or indirectly elicit weights for the Dymchurch case study. For this reason, analysis of scores combined with monetary costs and benefits was by means of the Constrained Random Weight Generator (CRWG). A CRWG analysis considers options sequentially starting from the 'do-nothing' option as per the traditional benefit-cost and incremental benefit-cost ratio analyses. The same rules and guidance are used as the traditional flood defence appraisals. Details of the principles and mechanism behind the CRWG are provided in Section 7 of the main report.

As described elsewhere, for a given comparison, the CRWG is programmed to identify more than 1,000 sets of weights where the total weighted intangible score (I) combined with k is sufficiently large to bring the overall benefit cost ratio and/or incremental benefit cost ratio within the bounds of the decision rules. The larger the I-score, the smaller (and, depending on context, the more reasonable) the value of k has to be.

The analysis was used to identify:

- whether it is mathematically possible for one option be preferred over others;
- if it is mathematically possible for one option to be preferred over another, whether this occurs within reasonable limits of the value of k (where this can either be unreasonably high); and
- if it is at least possible that it could be preferred within a reasonable value of k, whether the conditions for this in terms of the relative weights between categories of impact are reasonable.

6.1.2 Application of CRWG analysis to Dymchurch

For Dymchurch there are five options including the 'do-nothing' option. The results of the appraisal of monetary costs and benefits for the different options are presented in Table 6.1.

Table 6.1: Summary table of monetary costs and benefits

	Costs and benefits £k				
	Do-nothing	Maintain	Sustain	Improve Shingle	Improve Sand
PV costs from estimates		2,100	32,300	38,600	56,500
Optimism bias adjustment		1,260	19,380	23,160	33,900
Total PV costs for appraisal PVc		3,360	51,680	61,760	90,400
PV damage PVd	213,811	87,122	29,067	5,323	5,323
PV damage avoided		126,689	184,743	208,488	208,488
Total PV benefits PVb		126,689	184,743	208,488	208,488
Net Present Value NPV		123,329	133,063	146,728	151,988
Average benefit/cost ratio		37.70	3.57	3.38	2.31
Incremental benefit/cost ratio			1.20	2.36	0.61

The procedure to run the CRWG analysis developed through the following steps:

- first, the scores and economic costs of each option were introduced into the 'score and costs sheet';
- in the 'front sheet', the competing options were selected and the required incremental benefit-cost ratio was entered. With this information, the weights were calculated;
- at this stage it is also possible to introduce rules or constraints to the weights being calculated. So, for example, specifying that environmental impacts are always more important than social impacts. This step was not possible in the Dymchurch case study, since no weight or rank elicitation was carried out;
- once the software completes its run, the 'front sheet' will provide information on the quantity of weight sets calculated, the number of weight combinations tried and the success rate of finding 'winning' weights per thousand combinations;
- the software will then move across to the 'results sheet' where, as the name says, the results of the weight calculation are displayed. The most important set of results that the software provides relate to absolute and average values of k minimum and k maximum for which the option that was set up to 'win', wins; and
- upon these results, a judgement is made as to whether the decision process should proceed to the next incremental option or not.

The data presented in Table 6.1, above, together with the category scores for each option were entered into the CRWG and the programme was run four times, as follows:

- once to ascertain whether it was feasible for the Sustain option to be preferred against the Maintain option;
- another time to ascertain whether it was feasible for Improve with Sand option to be preferred against the Sustain option;

- another time to ascertain in which circumstances the Improve with Shingle option would not be the preferred one in relation to Sustain. There was no need to calculate weights for the Improve with Shingle option to be preferred against the Sustain option because, this option fulfilled the decision making requirements and could be justified on economic terms alone; and, finally,
- another time to compare Improve-shingle with Improve-sand.

The CRWG results are presented in Table 6.2.

Table 6.2: Summary of results from the constrained random weight generator analysis

Operation	Absolute		Size of weight population	Constraints introduced
	K min (£k)	K max (£k)		
Maintain versus Sustain	3,300	21,000	1000	No constraints
Sustain versus Improve-shingle	-	-	-	-
Sustain versus Improve-sand	658	21,000	1000	No constraints

The discussion as to which is the preferred option given these results is provided in Section 7.

Maintain versus sustain

The CRWG analysis also provides an indication of the frequency distribution of the weights by type and category of impacts so as to give an idea of the pattern to the weights required to achieve the starting condition (i.e. which sets of weights make Sustain the preferred option). Figure 6.1 provides a distribution of the magnitude of weights for each type of impact in the population of 1000 weights where Sustain is justified.

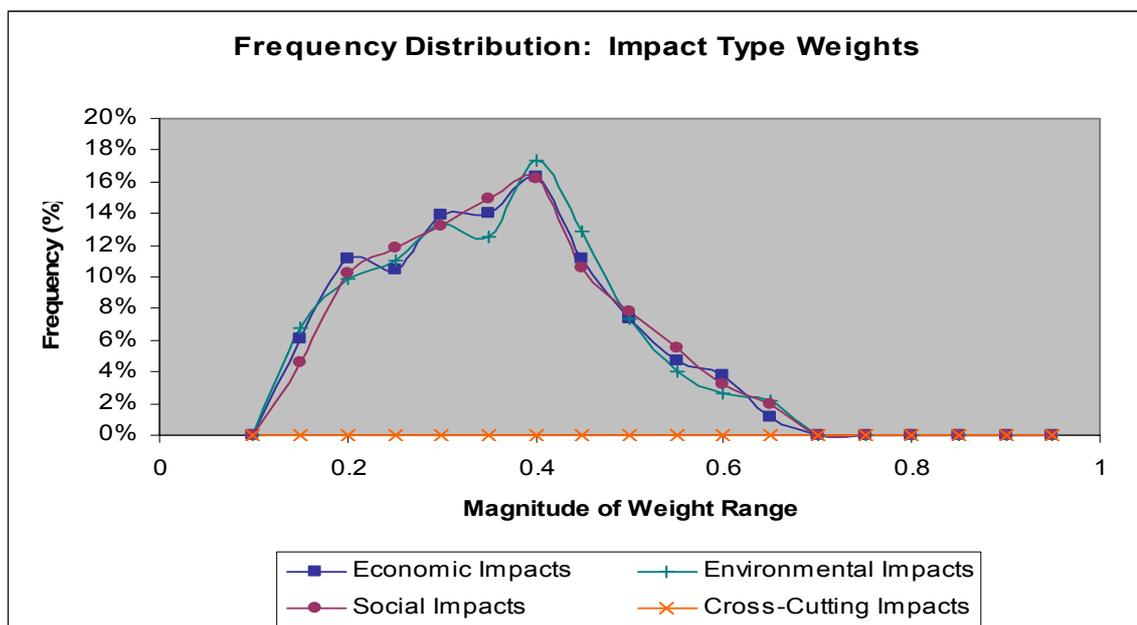


Figure 6.1 Sustain weight distribution for impact types

As it can be observed in Figure 6.1, there is no particular pattern in the set of weights, meaning that there is no one particular type of impact (economic, environmental, social or cross-cutting) that has to be more important than the others. This also means that the decision must depend on whether the value of k_{min} is reasonable or not. At first glance, and considering the information in the ASTs, the value seems a little bit high. Further discussion of this issue is presented in Section 7.

Sustain versus improve-shingle

The comparative analysis between Sustain and Improve–shingle was not necessary because the incremental benefit-cost ratio is above the required 1.5. Nonetheless, the CRWG was run to ascertain in which conditions Improve–shingle would not be preferred to Sustain. The software did not find any set of weights when this condition was true.

Sustain versus improve-sand

Figure 6.2 provides an illustration of the frequency distribution of the weights by type of impacts in order for the Improve-sand option to be preferred relative to Sustain. Again, the Figure shows that there is no particular pattern of weights, leading us to believe that the decision lies on whether the value of k_{min} is reasonable or not (see discussion in Section 7).

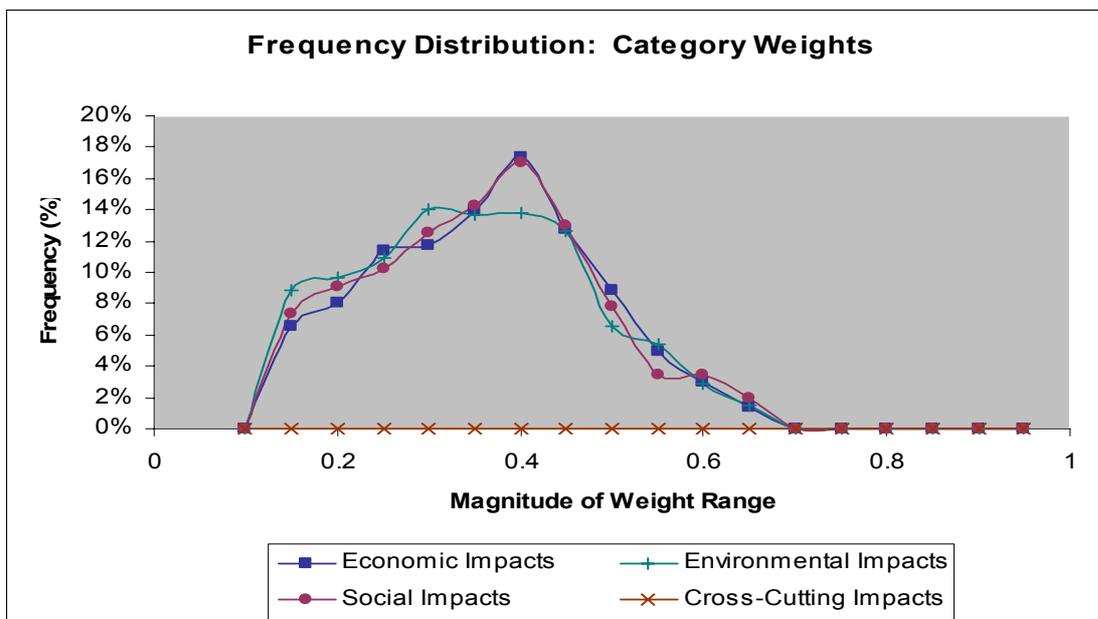


Figure 6.2 Improve-sand weight distribution for impact types

Improve-shingle versus improve-sand

Finally, a comparison between the two improve options was carried out. Both options provide a standard of defence from 1 in 50 return year event; therefore they are not incremental against each other. Nonetheless, in the eventuality of both options being preferred against Sustain, it will be necessary to decide which of them is preferred in relation to the other.

The CRWG was run for these two options, and it became clear after some time that the software could not find a set of weights where Improve-sand would be preferred against Improve-shingle. This result is potentially related to the fact that there is not many differences between the scores of these two options, both of them scoring significantly highly, but the Improve-sand option is significantly more costly than Improve-shingle. In other words it is difficult to justify the increase in costs on the basis of small differences in benefits.

7. Comparison of options

7.1 Selecting the preferred option

The selection of the preferred option in the MCA-based methodology follows, in general terms, the decision-making process principles set out in the FCDPAG 3 but it extends them to allow the inclusion of intangible benefits.

In simple terms, the decision making process in the MCA-based methodology is based around the option with the highest benefit-cost ratio, with higher options only selected if their incremental benefit-cost ratio exceeds a set threshold or if the intangible benefits are enough to take the initial incremental benefit-cost ratio over the set threshold.

For Dymchurch, there are five options including the 'do-nothing' option. The results of the monetary costs and benefits and the summary of the results of the CRWG analysis of the different options are presented in Table 7.1.

Table 7.1: Summary table of monetary costs and benefits

	Costs and benefits £k				
	Do-nothing	Maintain	Sustain	Improve Shingle	Improve Sand
Total PV costs from estimates (including optimism bias at 60%)		3,360	51,680	61,760	90,400
PV damage PVd	213,811	87,122	29,067	5,323	5,323
PV damage avoided		126,689	184,743	208,488	208,488
Total PV benefits PVb		126,689	184,743	208,488	208,488
Net Present Value NPV		123,329	133,063	146,728	151,988
Average benefit/cost ratio		37.70	3.57	3.38	2.31
Incremental benefit/cost ratio			1.20	2.36	0.61
Required Incremental benefit/cost ratio			1.5	1.5	1.5*
Estimated minimum required extra benefits to move to higher option			14,400 [#]	-	58,000 ^{##}
k min (per point) from CRWG			3,300	-	720

Notes: * Since the 'improve' options only take the standard to the edge of the indicative standard of defence, it was considered that the required incremental benefit-cost ratio was still 1.5, instead of 3;

[#] Calculated from the difference in costs between Sustain and Maintain (£51,680k - £3,360k) multiplied by the required incremental benefit-cost ratio (1.5);

^{##} Calculated from the difference in costs between Improve-Sand and Sustain (£90,400k - £51,680k) multiplied by the required incremental benefit-cost ratio (1.5).

The option with the highest benefit-cost ratio is Maintain (37.7), hence, this is the starting point for selecting the preferred option. The incremental benefit-cost ratio of Sustain is 1.2, which is not considered robustly greater than 1 based on the monetised benefits. The intangible benefits must be worth at least £14.4

million, to increase the incremental benefit-cost ratio of Sustain over Maintain to 1.5 (see Table 7.1).

The CRWG results show that the Sustain option achieves an overall incremental benefit cost ratio of greater than 1.5 when k_{min} is £3.3 million. This is quite a high value and needs to be considered in the context of the difference in points between the weighted scores of the competing options.

The use of the CRWG means that the weighted scores for the options are not available. However, consideration of the AST shows that the only differences between the Maintain and Sustain options relate to the social impacts categories, in particular the 'health and safety' and 'availability and accessibility of services' categories. This information in addition to examples of the economic values associated with similar impacts or activities can assist in determining whether the required k per point value appears reasonable.

The comparator table (Table 6.1 in the FD2013/PR) sets out some examples of the financial or economic value associated with different impacts or activities. These are given here to aid thinking processes. The values can be compared against the impact category scores (and other information recorded in the AST) to provide a context for deciding whether or not an implied k value of protecting a habitat, for example, would appear reasonable.

The estimates relating to health and safety in the comparator table suggest that expenditure per household per year on law and security is £1,160 and on health is £3,600 per household per year. Hence, a figure of £4,760 per household per year is used to indicate the value of health and safety to local residents. For the health and safety impacts to be worth at least £3,300,000 (k_{min} calculated by the CRWG), a total of 693 properties must be flooded over the 100-year time horizon.

Maintain offers a standard of defence of 1 in 10 reducing to 1 in 3 over time and Sustain offers a standard of defence of 1 in 10 throughout the 100-year time horizon. Therefore, the difference between the Maintain and Sustain options occurs for flood events greater than 1 in 3 but less than 1 in 10. A 1 in 9 year flood would be expected to occur, on average, 11 times over a 100-year time horizon. It is known (from the AST) that on each event, 2,471 residential properties would be affected by the flood. If the health and safety value is £4,760 per property and 11 floods occur over the 100-year time horizon, the indicative total damages can be estimated at almost £130 million. This suggests that it is not unreasonable to assume that the Sustain option is justified.

Nonetheless, it may also be appropriate to obtain weights from local stakeholders to confirm the importance of the social impacts. This would allow weighted scores to be calculated and a more precise indication to be estimated of the level of intangible benefits required to make Sustain the preferred option.

Option 4 – Improve with shingle (1 in 50)

If the Sustain option is justified, the analysis proceeds to consideration of the incremental benefits of moving to Option 4, improve with shingle. Because Option 4 represents an increase to the minimum indicative standard for the area (but not above), it requires an incremental benefit-cost ratio of greater than 1.5 to be justified.

As it can be seen in Table 7.1, incremental benefit-cost ratio is 2.36, therefore this option is justified on economic arguments alone and no additional intangible benefits are required.

Option 5 – Improve with sand (1:50)

Having identified that Option 4 was likely to be justified, the next consideration was whether Option 5, improve with sand could be justified. Option 5 offers a standard of defence of 1 in 50 for the area, i.e. the same as Option 4. Hence, Improve with Sand is only incremental over Sustain and, therefore, to be justified it must also achieve an overall incremental benefit-cost ratio of greater than 1.5.

As it can be seen in Table 7.1, the incremental benefit-cost ratio for this option is 0.61. In order to raise this to 1.5, the minimum value of the intangible benefits required is £58 million.

With no constraints operating on the relative magnitude of weights, the CRWG analysis identified that Option 5 can only be justified when k is greater than an absolute minimum of £720,000. Here k relates to a per point difference in the weighted scores of the two options, rather than a total value as previously given.

The Improve with Sand option is scored as the best option for all categories (i.e. has an unweighted score of 100). Therefore, there are considerable differences in intangible benefits between Option 5 and Sustain for all impact categories with the exception of the 'sense of community' where both options score the same. Given the quantity of differences between the two options, it is considered that a weight elicitation exercise is required to assess the relative importance of the categories. This will allow the weighted scores to be calculated and the value of the indicative benefits required to allow Option 5 (improve-sand) to be preferred over Sustain.

The information gathered from the weight elicitation exercise will also be important when considering the relative benefits of Option 4 (improve-shingle) against Option 5 (improve-sand), as differences between these two options are only reflected in the intangible scores. For the weight elicitation exercise to be valuable in identifying the differences between Options 4 and 5 it would also need to focus on the relative importance of 'landscape and visual amenity', 'equity' and 'business development'.

8. References

Babtie Group (2003): High Knock to Dymchurch Redoubt Sea Defence Scheme – Environmental Scoping Study, Internal Working Paper, Revision II, October 2003.

Babtie Brown & Root (2003): High Knock to Dymchurch Redoubt Communication Plan – Draft R02.

Environment Agency (2004): Project Appraisal Report for the High Knock to Dymchurch Redoubt Sea Defences, Environment Agency Southern Region, April 2004.

HR Wallingford (2001): Folkestone to Rye Coastal Defence Strategy Study – Main Report, report downloaded from Folkestone to Rye Coastal Defence Strategy Internet site (<http://www.folkestone-rye.net>).

HR Wallingford (2001): Folkestone to Rye Coastal Defence Strategy Study – Executive Summary, report downloaded from Folkestone to Rye Coastal Defence Strategy Internet site (<http://www.folkestone-rye.net>).

HR Wallingford (2003): Contingent Valuation Method Survey – Dymchurch (Draft), Report EX 4670, February 2003.

Roncarati Research Group (2002): Dymchurch Beach Users Survey, report prepared for HR Wallingford Ltd, September/October 2002.

Appendix B3.1

Appraisal summary table for high level Screening – S-AST for Dymchurch sea defence scheme

Table B3.1.1: Appraisal summary table for flood management and coastal defence – high level screening

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.		
Assumptions		The high level screening will correspond to the 'do-nothing' option.		
Impact category	Impact likely? (Y/N)	Impact Details	Qualitative / quantitative assessment	Monetary valuation
Economic impacts				
Assets	Y	<ul style="list-style-type: none"> potential flooding of high density housing in Dymchurch village and nearby coastal strip high density housing north and south due to breach or heavy overtopping between High Knock and Dymchurch Redoubt; potential impact of holiday camps, industrial and business developments due to breach or heavy overtopping between High Knock and Dymchurch Redoubt; potential impact to car parks (MU 18/7 – 18/10); potential impact to caravan site in Holiday Park (?); potential impact to drains and sewers of the urban and countryside area; potential impact to the Marshland outfall (MU 18/7 – 18/10) potential impact to High Knocke and Dymchurch slipway (MU 18/7 – 18/10); potential impact to Willtop pumping station (MU 18/11 – 18/13); potential impact Willtop and Grand Redoubt outfalls (MU 18/11 – 18/13); potential impact to Ogarswick landfill site (MU 18/11 – 18/13); potential impact to schools, churches and other public buildings in Dymchurch and surrounding villages; 		✓
Land use	Y	<ul style="list-style-type: none"> potential impact to Grade 3 agricultural land in the northern section of the study area, which extends to the coast at Dymchurch Redoubt; potential impact to Grade 1 and 2 agricultural land in Romney Marsh; 		✓
Transport	N	<ul style="list-style-type: none"> wave overtopping can cause disruption to traffic on the A259(T), between High Knock and Dymchurch Redoubt; potential permanent impact on the A259, between High Knock and Dymchurch Redoubt; potential impact to a number of minor roads crossing Romney Marsh and connecting villages and farms; potential impact to the Romney, Hythe and Dymchurch Railway landward of the A259; 		
Business development	Y	<ul style="list-style-type: none"> potential impacts of tourism industry in general. 	✓	

Table B3.1.1: Appraisal summary table for flood management and coastal defence – high level screening

Project name	Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Assumptions	The high level screening will correspond to the 'do-nothing' option.			
Impact category	Impact likely? (Y/N)	Impact Details	Qualitative / quantitative assessment	Monetary valuation
Environmental impacts				
Physical habitats	Y	<ul style="list-style-type: none"> potential impact to SNCI located at Dymchurch, consisting of a small area of relic grazing marsh and provides one of the only areas which as not been converted to arable and hosts several rare and scarce species of flora and fauna; potential impact to freshwater dykes that run through the marshy grassland, exhibiting fresh water flora, water voles, yellowhammer and sedge wabler; potential impact to the Site of Nature Conservation Interest (SNCI) at Hythe Ranges (outside the study area but adjoins the northern boundary). The site comprises of shingle backed by grassland and scrub (used by MOD) and hosts several rare and scarce species of flora and fauna (vegetated shingle is a BAP priority habitat); potential impact to vegetated shingle that constitutes a priority habitat under the Biodiversity Action Plan; potential impact to the sandy shores of Dymchurch which are used by shorebirds for roosting sites; potential impact to Romney Warren SSSI and pLNR; potential impact on natural spawning and nursery grounds for many species of fish (for example lemon sole, sole, sprat and mackerel); 	✓	
Water quality	Y	<ul style="list-style-type: none"> potential impact to coastal waters quality during construction; potential impact to coastal waters quality during flooding due to increased flushing of agricultural land; 	✓	
Water quantity	N			
Natural processes	N			
Historical environment	Y	<ul style="list-style-type: none"> potential impact to Martello Tower and Dymchurch Redoubt both Schedule Ancient Monuments; potential impact to 9 monuments listed on the Sites and Monuments Register; potential damage to two Conservation Areas within Dymchurch; potential impact to 22 listed buildings within the Civil Parish of Dymchurch; potential impact to 13th Century sea wall; potential impact to Fort Lodge, World War II underground operational post and Saxon site; potential site of high archaeological potential located near Dymchurch can be damaged under do-nothing; potential impact to ancient churches in Romney Marsh; potential impact to potential evidence for Roman settlements in Romney Marsh; 		✓

Table B3.1.1: Appraisal summary table for flood management and coastal defence – high level screening

Project name	Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Assumptions	The high level screening will correspond to the 'do-nothing' option.			
Impact category	Impact likely? (Y/N)	Impact Details	Qualitative / quantitative assessment	Monetary valuation
Landscape and visual amenity	Y	<ul style="list-style-type: none"> potential impact to the beach feature at Dymchurch which is a key feature in the landscape; potential impact to cultural landmarks (such as churches, barns, etc.) (also considered in heritage); potential impact to Romney Marsh (also considered in agriculture); potential impact amenity if sand beach loses quality; 	✓	
Social impacts				
Recreation	Y	<ul style="list-style-type: none"> potential impact to slipways at Dymchurch and High Knocke; potential impact to other water sports that occur in the area such as jet skiing; potential impact to bait digging activities; potential impact to angling activity occurring in the area; potential impact to Romney, Hythe and Dymchurch Railway, MW's amusement park, Martello Tower 24, two caravan parks and an Holiday Village; potential impact to promenade on top of sea wall; potential impact to several accesses to beach (steps over sea wall); potential impact through the Town centre; potential impact to Lathe Barn Farm; 		✓
Health and safety	Y	<ul style="list-style-type: none"> potential risk to local population from flooding and breaching of defences; potential impacts of stress and anxiety to local population from possibility flooding and/or breaching of defences; potential safety impacts due to state of defences to local population 	✓	
Availability and accessibility of services	Y	<ul style="list-style-type: none"> potential loss of accessibility to services due to flooding of A259 and rural and local roads. potential loss of availability of services due to flooding of local facilities (churches, schools, hospital, etc.). potential loss of tourism facilities may have a knock-on effect on local shops, business, etc., that may result in loss of services to local people (and to visitors to the area).; 	✓	
Equity	Y	<ul style="list-style-type: none"> potential increase deprivation in an area that relies on income from tourism and recreation; 	✓	
Sense of community	Y	<ul style="list-style-type: none"> potential loss to daily life routine due to flooding of city centre; 	✓	
Cross-cutting impacts				
Policy integration	N			

Appendix B3.2:

Appraisal summary table for main assessment – MA-AST for the Dymchurch sea defence scheme

Table B3.2.1 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		'DO-NOTHING'			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 15 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Economic impacts					
Assets	Y	<p>Flooding of residential and industrial properties, including car parks, schools, churches and other public buildings in Dymchurch village and nearby coastal strip due to breach or heavy overtopping between High Knock and Dymchurch Redoubt.</p> <p>Flooding/loss of tourism business developments and holiday camps in Dymchurch village and nearby coastal strip due to breach or heavy overtopping between High Knock and Dymchurch Redoubt.</p> <p>Flooding/erosion of drains and sewers of the urban and countryside area, including the Marshland, Willtop and Grand Redoubt outfalls.</p> <p>Flooding/erosion of High Knocke and Dymchurch slipway and of the Willtop pumping station.</p>	<p>2471 dwellings will be flood damage, 1147 of which would be written off (level of damage would exceed value of the property).</p> <p>Average value of property: £167,000 (Draft PAR, EA 2004).</p> <p>3 holiday parks (excluding caravans) will be affected. One is a Special Park and will be written-off, with a lost value of £808,000 and the other two will be flooded frequently (further away from the frontage) with a recurrent damage value of £65,000.</p> <p>927 caravans will be lost if not moved. Assuming a value of £2000 per caravan (HR Wallingford, 2001) the total value lost is 1.8 million.</p> <p>Replacement costs of outfalls and pumping stations: £200,000. Total replacement cost is £800,000. This</p>	-	<p>Damages of £197m</p> <p>(£25m from intermittent flooding and £172m of write-off losses)</p>

Table B3.2.1 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		'DO-NOTHING'			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 15 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
			value is a conservative estimate as it does not include drains and sewers on the urban and countryside area.		
Land use	Y	According to the draft PAR, 7672 ha of agricultural land (Grade 3) will be at risk from flooding. In addition, 113 ha of the land in Romney Marsh SSSI will also be flooded (this will be considered to be Grade 1 agricultural land).	Considering a value of £387 per ha for loss of output for a single year of grade 1 land, the total loss value for Romney Marsh is approximately £44,000.	-	(included in the monetary value of assets)
Transport	Y	Flooding of the A259, between High Knock and Dymchurch Redoubt. Flooding of a number of minor roads crossing Romney Marsh and connecting villages and farms.	Depending on whether the roads of the Marsh are passable or not, the total marginal resource costs of diverting traffic from the A259, assuming 12h of disruption is between £3,551 and £9,353.	-	£3m
Business development	Y	Loss of beach and tourist facilities is likely to have knock-on impact on economy of the area town (which relies to a large extent on tourism and recreation) such that business development is also likely to be reduced. The Dymchurch shopping area, for example, is close to the sea front. However, along the coast there are other businesses centres.		0/55	

Table B3.2.1 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		'DO-NOTHING'			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 15 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Environmental impacts					
Physical habitats	Y	<p>Flooding of the Site of Nature Conservation Interest (SNCI) located behind Dymchurch village, consisting of a small area of relic grazing marsh and providing one of the only areas which as not been converted to arable and hosts several rare and scarce species of flora and fauna;</p> <p>Potential flooding of freshwater dykes that run through the marshy grassland, exhibiting fresh water flora, water voles, yellowhammer and sedge warbler;</p> <p>Flooding of the SNCI at Hythe Ranges (outside the study area but adjoins the northern boundary). The site comprises of shingle backed by grassland and scrub (used by MOD) and hosts several rare and scarce species of flora and fauna (vegetated shingle is a BAP priority habitat);</p> <p>Erosion of vegetated shingle that constitutes a priority habitat under the Biodiversity Action Plan.</p> <p>Erosion to the sandy shores of Dymchurch that are used by shorebirds for roosting sites.</p> <p>Impact to Romney Warren SSSI</p>		-	

Table B3.2.1 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		'DO-NOTHING'			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 15 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
		and pLNR. Impact on natural spawning and nursery grounds for many species of fish (for example lemon sole, sole, sprat and mackerel).			
Water quality	Y	Deterioration of defences may impair water quality status. Impact to coastal waters quality during flooding due to increased flushing of agricultural land.		0/1	
Water quantity	N			-	-
Natural processes	N			-	-
Historical environment	Y	Erosion of Martello Tower and Dymchurch Redoubt both Schedule Ancient Monuments (SAM). Flooding/erosion to 9 monuments listed on the Sites and Monuments Register; Flooding to two Conservation Areas within Dymchurch, the Church Area and the High Street Area, and 22 listed buildings. Erosion of the sea wall that dates back to the 13 th Century and of Fort Lodge, World War II underground operational post and Saxon site. Impact on site of high archaeological potential located near Dymchurch. Impact to ancient churches and evidence of Roman settlements	Potential Loss of: 2 SAMs; 9 Registered Monuments; 2 Conservation Areas; 22 Listed Buildings; Seawall from 13 th Century; 1 Saxon Site; 1 high archaeological potential site. Nominal value of £2m for each (HR Wallingford, 2001)	-	(included in the monetary value of assets)

Table B3.2.1 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		'DO-NOTHING'			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 15 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
		in Romney Marsh.			
Landscape and visual amenity	Y	Erosion of beach at Dymchurch, which is a key feature in the landscape and amenity of the area. Impact to cultural landmarks (such as churches, barns, etc.) (also considered in historical environment). Impact to Romney Marsh (also considered in land use).		0/1	
Social impacts					
Recreation	Y	Erosion of slipways at Dymchurch and High Knocke, with impact on in water activities such as sailing, fishing, etc. Impact to Romney, Hythe and Dymchurch Railway, MW's amusement park, Martello Tower 24, two caravan parks and an Holiday Village; Erosion of to promenade on top of sea wall with impact on recreational activities such as walking, sight seeing. In addition the access to the beach over the sea wall would be lost.	Loss of promenade on top of seawall. Assuming 160,000 visits to the town per year (HR Wallingford, 2003) with willingness to pay of £3.59 per visit (based on deterioration in beach and promenade in Multi-Coloured Manual, from study in Yellow Manual) gives lost annual value to recreation of: 160,000 x £3.59 = £574,400 per year	-	£14m
Health and safety	Y	Risk to local population from flooding and breaching of defences; Stress and anxiety to local population from possibility flooding and/or breaching of defences; Potential health and safety		0/1	

Table B3.2.1 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		'DO-NOTHING'			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 15 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
		issues if defences deteriorate and no warning signs are out in place.			
Availability and accessibility of services	Y	Potential loss of accessibility to services due to flooding of A259 and rural and local roads. Potential loss of availability of services due to flooding of local facilities (churches, schools, hospital, etc.). Loss of tourism facilities may have a knock-on effect on local shops, business, etc., that may result in loss of services to local people (and to visitors to the area).		0/1	
Equity	Y	Loss of facilities, both for tourists and locals, is likely to result in local job losses and may increase deprivation in an area that relies on income from tourism. Loss of beach access would also affect recreation in the area (again for visitors and locals) and would reduce the quality of life.		0/65	
Sense of community	Y	Loss of businesses, employment and some properties is likely to reduce the sense of community.		0/54	
Cross-cutting impacts					
Policy integration	N			-	-

Table B3.2.2 Appraisal summary table for flood management and coastal defence – main assessment

Project name	Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.				
Description of option	MAINTAIN - DO MINIMUM (current annual maintenance reactive works to sea wall, and groyne field to maintain a standard of defence of 1 in 10, reducing overtime to 1 in 3).				
Description of area affected by option	Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.				
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
<i>Economic impacts</i>					
Assets	Y	<p>Protection of residential and industrial properties, including car parks, schools, churches and other public buildings in Dymchurch village and nearby coastal strip to a standard of 1 in 10 years, reducing to 1 in 3 over time.</p> <p>Protection of tourism business developments and holiday camps in Dymchurch village and nearby coastal strip to a standard of 1 in 10 years, reducing to 1 in 3 over time.</p> <p>Protection of drains and sewers of the urban and countryside area, including the Marshland, Willtop and Grand Redoubt outfalls to a standard of 1 in 10 years, reducing to 1 in 3 over time.</p> <p>Protection of erosion of High Knocke and Dymchurch slipway and of the Willtop pumping station to a standard of 1 in 10 years, reducing to 1 in 3 over time.</p>	<p>Intermittent flooding of:</p> <p>2471 dwellings;</p> <p>3 holiday parks;</p> <p>927 caravans;</p>	-	Damages of 46m
Land use	Y	No change in current land use in the medium term, but progressively more frequent flooding of agricultural land due to overtopping of defence s could mean land use change in the long term.		-	(included in the monetary value of assets)

Table B3.2.2 Appraisal summary table for flood management and coastal defence – main assessment

Project name	Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.				
Description of option	MAINTAIN - DO MINIMUM (current annual maintenance reactive works to sea wall, and groyne field to maintain a standard of defence of 1 in 10, reducing overtime to 1 in 3).				
Description of area affected by option	Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.				
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Transport	Y	Protection of the A259, between High Knock and Dymchurch Redoubt to a standard of 1 in 10 years, reducing to 1 in 3 over time. Protection of a number of minor roads crossing Romney Marsh and connecting villages and farms.		-	£41m
Business development	Y	The tourism business would be protected to the current level of protection with no significant impacts. Over time there may be some impacts on the economy of the area as a knock-on effect from frequent flooding of tourist and local facilities.		70/85	

Table B3.2.2 Appraisal summary table for flood management and coastal defence – main assessment

Project name	Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.				
Description of option	MAINTAIN - DO MINIMUM (current annual maintenance reactive works to sea wall, and groyne field to maintain a standard of defence of 1 in 10, reducing overtime to 1 in 3).				
Description of area affected by option	Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.				
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Environmental Impacts					
Physical habitats	Y	<p>Protection of the Site of Nature Conservation Interest (SNCI) located at Dymchurch and the SNCI at Hythe Ranges to a 1 in 10 standard of defence, reducing to 1 in 3 over time. In the long term there may be some impacts to the small area of relic grazing (Dymchurch) due to more frequent flooding;</p> <p>Protection of freshwater dykes to a 1 in 10 standard of defence, reducing to 1 in 3 over time. In the long term there may be some impacts to the freshwater dykes due frequent flooding;.</p> <p>Protection of the Romney Warren SSSI and pLNR.</p> <p>Protection of vegetated shingle that constitutes a priority habitat under the Biodiversity Action Plan.</p> <p>Because this option does not include replacement of the groyne fields there may be some erosion of the sandy shores of Dymchurch and the vegetated shingle in the long term, as well as impacts on the natural spawning and nursery grounds for many species of fish (for example lemon sole, sole, sprat and mackerel).</p>		-	

Table B3.2.2 Appraisal summary table for flood management and coastal defence – main assessment

Project name	Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.				
Description of option	MAINTAIN - DO MINIMUM (current annual maintenance reactive works to sea wall, and groyne field to maintain a standard of defence of 1 in 10, reducing overtime to 1 in 3).				
Description of area affected by option	Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.				
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Water quality	Y	There will be some impacts on the water quality due to overtopping of defences and flushing of agricultural land.	If one assumes that the water quality will be only influenced by the occurrence of overtopping, the impact existence will depend on the probability of flooding, which in this case is 0.1.	20/20	
Water quantity	N			-	-
Natural processes	N			-	-
Historical Environment	Y	Protection to a 1 in 10 standard of defence, reducing to 1 in 3 over time of Martello Tower and Dymchurch Redoubt both Schedule Ancient Monuments (SAM), 9 monuments listed on the Sites and Monuments Register, two Conservation Areas within Dymchurch, 22 listed buildings, on site of high archaeological potential located near Dymchurch and of ancient churches and evidence of Roman settlements in Romney Marsh. In the long term there may be some impacts to these structures due to more frequent flooding. This option will repair the sea wall as and when necessary, however it still may lose some of its historical interest as the 13 th		-	(included in the monetary value of assets)

Table B3.2.2 Appraisal summary table for flood management and coastal defence – main assessment

Project name	Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.				
Description of option	MAINTAIN - DO MINIMUM (current annual maintenance reactive works to sea wall, and groyne field to maintain a standard of defence of 1 in 10, reducing overtime to 1 in 3).				
Description of area affected by option	Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.				
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
		century material is substituted by present day cement.			
Landscape and visual amenity	Y	Protection of cultural landmarks (such as churches, barns, etc.) (also considered in historical environment) and of Romney Marsh (also considered in land use). Because this option does not include replacement of the groyne field, in the long term there may be erosion of beach at Dymchurch, which is a key feature in the landscape and amenity of the area.		86/86	
Social impacts					
Recreation	Y	Protection of slipways at Dymchurch and High Knocke, Romney, Hythe and Dymchurch Railway, MW's amusement park, Martello Tower 24, two caravan parks a Holiday Village and promenade and beach access to a standard of protection to 1 in 10 years, reducing to 1 in 3 over time.	No loss of recreation in the short and medium term.	-	0
Health and safety	Y	Health and safety issues would no longer be an issue as defences are repaired.		12/12	

Table B3.2.2 Appraisal summary table for flood management and coastal defence – main assessment

Project name	Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.				
Description of option	MAINTAIN - DO MINIMUM (current annual maintenance reactive works to sea wall, and groyne field to maintain a standard of defence of 1 in 10, reducing overtime to 1 in 3).				
Description of area affected by option	Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.				
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Availability and accessibility of services	Y	Protection of accessibility and availability of services (A259 and rural and local roads, local facilities, tourist facilities) to a 1 in 10 standard, reducing to 1 in 3 over time. As the flooding becomes more frequent in the long term, the availability and accessibility of services may become an issue once more.		12/12	
Equity	Y	No significant impacts on equity would be observed under this option. However, as the flooding becomes more frequent in the long term, equity may become an issue once more.		79/79	
Sense of community	Y	No significant impacts on equity would be observed under this option. However, as the flooding becomes more frequent in the long term, sense of community may become an issue once more.		100/100	
Cross-cutting impacts					
Policy Integration	N			-	-

Table B3.2.3 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		SUSTAIN (current maintenance works to sea wall and groyne field, taking into account sea level rise. Standard of Defence 1 in 10).			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
<i>Economic impacts</i>					
Assets	Y	<p>Protection of residential and industrial properties, including car parks, schools, churches and other public buildings in Dymchurch village and nearby coastal strip to a standard of 1 in 10 years.</p> <p>Protection of tourism business developments and holiday camps in Dymchurch village and nearby coastal strip to a standard of 1 in 10 years.</p> <p>Protection of drains and sewers of the urban and countryside area, including the Marshland, Willtop and Grand Redoubt outfalls to a standard of 1 in 10 years.</p> <p>Protection of erosion of High Knocke and Dymchurch slipway and of the Willtop pumping station to a standard of 1 in 10 years.</p>	<p>Intermittent flooding of:</p> <p>2471 dwellings;</p> <p>3 holiday parks;</p> <p>927 caravans;</p>	-	Damages of 14m
Land use	Y	No change in current land.		-	(included in the monetary value of assets)

Table B3.2.3 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		SUSTAIN (current maintenance works to sea wall and groyne field, taking into account sea level rise. Standard of Defence 1 in 10).			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Transport	Y	Protection of the A259, between High Knock and Dymchurch Redoubt to a standard of 1 in 10 years. Protection of a number of minor roads crossing Romney Marsh and connecting villages and farms.		-	Damages£15m
Business development	Y	The tourism business would be protected to the current level of protection with no significant impacts.		70/85	
Environmental Impacts					
Physical habitats	Y	Protection of the Site of Nature Conservation Interest (SNCI) located at Dymchurch and the SNCI at Hythe Ranges to a 1 in 10 standard of defence. Protection of freshwater dykes, vegetated shingle Romney Warren SSSI and pLNR to a 1in 10 standard of defence.		-	

Table B3.2.3 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		SUSTAIN (current maintenance works to sea wall and groyne field, taking into account sea level rise. Standard of Defence 1 in 10).			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Water quality	Y	There will be some impacts on the water quality due to overtopping of defences and flushing of agricultural land.	If one assumes that the water quality will be only influenced by the occurrence of overtopping, the impact existence will depend on the probability of flooding, which in this case is 0.1.	20/20	
Water quantity	N			-	-
Natural processes	N			-	-
Historical Environment	Y	Protection to a 1in 10 standard of defence of Martello Tower and Dymchurch Redoubt both Schedule Ancient Monuments (SAM), 9 monuments listed on the Sites and Monuments Register, two Conservation Areas within Dymchurch, 22 listed buildings, on site of high archaeological potential located near Dymchurch and of ancient churches and evidence of Roman settlements in Romney Marsh. In the long term there may be some impacts to these structures due to more frequent flooding.		-	(included in the monetary value of assets)

Table B3.2.3 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		SUSTAIN (current maintenance works to sea wall and groyne field, taking into account sea level rise. Standard of Defence 1 in 10).			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Landscape and visual amenity	Y	Protection of cultural landmarks (such as churches, barns, etc.) (also considered in historical environment) and of Romney Marsh (also considered in land use). Protection of beach from erosion at Dymchurch, which is a key feature in the landscape and amenity of the area.		86/86	
Social impacts					
Recreation	Y	Protection of slipways at Dymchurch and High Knocke, Romney, Hythe and Dymchurch Railway, MW's amusement park, Martello Tower 24, two caravan parks a Holiday Village and promenade and beach access to a standard of protection to 1 in 10 years.	No loss of recreation in the short and medium term.	-	Damages£0
Health and safety	Y	Health and safety issues would no longer be an issue as defences are repaired.		20/20	
Availability and accessibility of services	Y	Protection of accessibility and availability of services (A259 and rural and local roads, local facilities, tourist facilities) to a 1 in 10 standard.		20/20	

Table B3.2.3 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		SUSTAIN (current maintenance works to sea wall and groyne field, taking into account sea level rise. Standard of Defence 1 in 10).			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Equity	Y	No significant impacts on equity would be observed under this option.		86/86	
Sense of community	Y	No significant impacts on equity would be observed under this option		100/100	
Cross-cutting impacts					
Policy integration	N			-	-

Table B3.2.4 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		IMPROVE with Shingle - Shingle beach recharge, structural work to upper wall and terminal rock groynes. Standard of Defence will be raised to 1 in 50.			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
<i>Economic impacts</i>					
Assets	Y	<p>Protection of residential and industrial properties, including car parks, schools, churches and other public buildings in Dymchurch village and nearby coastal strip to a standard of 1 in 50 years.</p> <p>Protection of tourism business developments and holiday camps in Dymchurch village and nearby coastal strip to a standard of 1 in 50 years.</p> <p>Protection of drains and sewers of the urban and countryside area, including the Marshland, Willtop and Grand Redoubt outfalls to a standard of 1 in 50 years.</p> <p>Protection of High Knocke and Dymchurch slipway and of the Willtop pumping station to a standard of 1 in 50 years.</p>	<p>Occasional flooding of:</p> <p>2471 dwellings;</p> <p>3 holiday parks;</p> <p>927 caravans;</p>	-	Damages £2m
Land use	Y	No change in current land.		-	(included in the monetary value of assets)

Table B3.2.4 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		IMPROVE with Shingle - Shingle beach recharge, structural work to upper wall and terminal rock groynes. Standard of Defence will be raised to 1 in 50.			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Transport	Y	Protection of the A259, between High Knock and Dymchurch Redoubt to a standard of 1 in 50 years. Protection of a number of minor roads crossing Romney Marsh and connecting villages and farms.			Damages £3m
Business development	Y	There would be no impacts on business development from policy of improving defences, with potential for increased development. There is also potential for opportunities for new business, as the beach would change from sand to shingle and potentially attracting a different type of user.		81/86	
Environmental impacts					
Physical habitats	Y	Protection of the Site of Nature Conservation Interest (SNCI) located at Dymchurch and the SNCI at Hythe Ranges to a 1 in 50 standard of defence. Protection of freshwater dykes, vegetated shingle Romney Warren SSSI and pLNR to a 1 in 50 standard of defence.		-	

Table B3.2.4 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		IMPROVE with Shingle - Shingle beach recharge, structural work to upper wall and terminal rock groynes. Standard of Defence will be raised to 1 in 50.			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Water quality	Y	There will be some impacts on the water quality due to overtopping of defences and flushing of agricultural land.	If one assumes that the water quality will be only influenced by the occurrence of overtopping, the impact existence will depend on the probability of flooding, which in this case is 0.2.	100/100	
Water quantity	N			-	-
Natural processes	N			-	-
Historical Environment	Y	Protection to a 1in 50 standard of defence of Martello Tower and Dymchurch Redoubt both Schedule Ancient Monuments (SAM), 9 monuments listed on the Sites and Monuments Register, two Conservation Areas within Dymchurch, 22 listed buildings, on site of high archaeological potential located near Dymchurch and of ancient churches and evidence of Roman settlements in Romney Marsh.		-	(included in the monetary value of assets)

Table B3.2.4 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		IMPROVE with Shingle - Shingle beach recharge, structural work to upper wall and terminal rock groynes. Standard of Defence will be raised to 1 in 50.			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Landscape and visual amenity	Y	Protection of cultural landmarks (such as churches, barns, etc.) (also considered in historical environment) and of Romney Marsh (also considered in land use). This option will create a significant change in the landscape from a traditionally sandy beach to a shingle beach. It is unlikely that such a change will have an impact on the visual amenity of the area.		66/66	
Social impacts					
Recreation	Y	Protection of slipways at Dymchurch and High Knocke, Romney, Hythe and Dymchurch Railway, MW's amusement park, Martello Tower 24, two caravan parks a Holiday Village and promenade and beach access to a standard of protection to 1 in 50 years.	No loss of recreation with potential for increase due to improved coastal defences.	-	Damages£0
Health and safety	Y	Health and safety issues would no longer be an issue as defences are repaired and improved.		100/100	
Availability and accessibility of	Y	Protection of accessibility and availability of services		100/100	

Table B3.2.4 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		IMPROVE with Shingle - Shingle beach recharge, structural work to upper wall and terminal rock groynes. Standard of Defence will be raised to 1 in 50.			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
services		(A259 and rural and local roads, local facilities, tourist facilities) to a 1 in 50 standard.			
Equity	Y	No significant impacts on equity would be observed under this option.		93/93	
Sense of community	Y	No significant impacts on equity would be observed under this option		100/100	
Cross-cutting impacts					
Policy integration	N			-	-

Table B3.2.5 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		IMPROVE with Sand –Sand beach recharge, structural work to upper wall and terminal rock groynes. Standard of Defence will be raised to 1 in 50.			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
<i>Economic impacts</i>					
Assets	Y	<p>Protection of residential and industrial properties, including car parks, schools, churches and other public buildings in Dymchurch village and nearby coastal strip to a standard of 1 in 50 years.</p> <p>Protection of tourism business developments and holiday camps in Dymchurch village and nearby coastal strip to a standard of 1 in 50 years.</p> <p>Protection of drains and sewers of the urban and countryside area, including the Marshland, Willtop and Grand Redoubt outfalls to a standard of 1 in 50 years.</p> <p>Protection of High Knocke and Dymchurch slipway and of the Willtop pumping station to a standard of 1 in 50 years.</p>	<p>Occasional flooding of:</p> <p>2471 dwellings;</p> <p>3 holiday parks;</p> <p>927 caravans;</p>	-	Damages of 2m
Land use	Y	No change in current land.		-	(included in the monetary value of assets)

Table B3.2.5 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		IMPROVE with Sand –Sand beach recharge, structural work to upper wall and terminal rock groynes. Standard of Defence will be raised to 1 in 50.			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Transport	Y	Protection of the A259, between High Knock and Dymchurch Redoubt to a standard of 1 in 50 years. Protection of a number of minor roads crossing Romney Marsh and connecting villages and farms.		-	Damages£3
Business development	Y	There would be no impacts on business development from policy of improving defences, with potential for increased development. There is also potential for opportunities for new business as the beach quality with improve with the recharge, attracting more tourists.		100/100	
Environmental impacts					
Physical habitats	Y	Protection of the Site of Nature Conservation Interest (SNCI) located at Dymchurch and the SNCI at Hythe Ranges to a 1 in 50 standard of defence. Protection of freshwater dykes, vegetated shingle Romney Warren SSSI and pLNR to a 1in 50 standard of defence.		-	

Table B3.2.5 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		IMPROVE with Sand –Sand beach recharge, structural work to upper wall and terminal rock groynes. Standard of Defence will be raised to 1 in 50.			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Water quality	Y	There will be some impacts on the water quality due to overtopping of defences and flushing of agricultural land.	If one assumes that the water quality will be only influenced by the occurrence of overtopping, the impact existence will depend on the probability of flooding, which in this case is 0.2.	100/100	
Water quantity	N			-	-
Natural processes	N			-	-
Historical environment	Y	Protection to a 1in 50 standard of defence of Martello Tower and Dymchurch Redoubt both Schedule Ancient Monuments (SAM), 9 monuments listed on the Sites and Monuments Register, two Conservation Areas within Dymchurch, 22 listed buildings, on site of high archaeological potential located near Dymchurch and of ancient churches and evidence of Roman settlements in Romney Marsh.		-	(included in the monetary value of assets)

Table B3.2.5 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		IMPROVE with Sand –Sand beach recharge, structural work to upper wall and terminal rock groynes. Standard of Defence will be raised to 1 in 50.			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Landscape and visual amenity	Y	Protection of cultural landmarks (such as churches, barns, etc.) (also considered in historical environment) and of Romney Marsh (also considered in land use). This option may potentially improve the landscape and visual amenity of the area, as it will improve the quality of the sandy beach which is a main feature of the area.		100/100	
Social impacts					
Recreation	Y	Protection of slipways at Dymchurch and High Knocke, Romney, Hythe and Dymchurch Railway, MW's amusement park, Martello Tower 24, two caravan parks a Holiday Village and promenade and beach access to a standard of protection to 1 in 50 years.	No loss of recreation with potential for increase due to improved coastal defences, and beach quality.	-	Damages of £0
Health and safety	Y	Health and safety issues would no longer be an issue as defences are repaired and improved.		100/100	
Availability and accessibility of services	Y	Protection of accessibility and availability of services (A259 and rural and local roads, local facilities, tourist facilities) to a 1 in 50 standard.		100/100	

Table B3.2.5 Appraisal summary table for flood management and coastal defence – main assessment

Project name		Dymchurch Coastal Defence Strategy, from High Knocke and Dymchurch Redoubt.			
Description of option		IMPROVE with Sand –Sand beach recharge, structural work to upper wall and terminal rock groynes. Standard of Defence will be raised to 1 in 50.			
Description of area affected by option		Residential, commercial and recreational areas of Dymchurch currently protected by seawall. There are also old timber groyne fields, which are generally in poor condition. The beach and foreshore are sandy although the former is only present over the southern half of the frontage. Under the current defence policy the standard of defence provided less than 1 in 10 years. Without the present level of maintenance some sections of the seawall are likely to fail within 5 years.			
Impact category	Impact likely? (Y/N)	Qualitative description of impacts	Quantitative assessment of impacts (no. units/monetary)	Score	Monetary value
Equity	Y	No significant impacts on equity would be observed under this option.		100/100	
Sense of community	Y	No significant impacts on equity would be observed under this option		100/100	
Cross-cutting impacts					
Policy integration	N			-	-